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Ethno-ornithological knowledge and uses of birds in Omi-aro and Labaka villages, Kwara State, Nigeria

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Summary

Information was gathered in two villages of western Nigeria on the vernacular names, food value, ornamental value, use in traditional healing, associated superstitions and augury, folklore, proverbs and quotes, and behavioural aspects such as feeding, mating, nesting and vocalizations, of 21 species of bird. Guided interviews using a questionnaire were employed to elicit responses from the informants, complemented by photographs of the 21 species. The villagers provided vernacular names and information on the cultural significance of the 21 bird species shown to them. Thirteen of the 21 species are common food sources, four species have magico-medicinal uses, feathers of six species are used in ornamentation and ten species are objects of superstitions. Birds are important in the language, with proverbs, idioms, wise sayings and poems rich in local bird names. The villagers in Omi-aro and Labaka have a strong relationship with birds, which have considerable cultural and economical significance to them. Further studies on traditional healing practices using birds, hunting methods and seasonality in hunting, are needed to improve understanding of the harvesting of birds for these purposes.

Résumé

Connaissances ethno-ornithologiques et utilisations des oiseaux dans les villages de Omi-aro et Labaka, Etat de Kwara, Nigeria. Des informations ont été recueillies dans deux villages de l'ouest du Nigeria sur les noms vernaculaires, la valeur alimentaire, la valeur ornementale, l'utilisation par les guérisseurs, les superstitions et présages associés, le folklore, les proverbes et

citations ainsi que sur des aspects comportementaux tels que l'alimentation, l'accouplement, la nidification et le chant pour 21 espèces d'oiseaux. Des entretiens semi-directifs conduits en se servant d'un questionnaire, complété par des photos des 21 espèces, ont été menés pour obtenir les réponses des informateurs. Les villageois ont fourni les noms vernaculaires et les informations sur l'importance culturelle des 21 espèces d'oiseaux qui leur ont été montrées. Treize des 21 espèces sont habituellement consommées, quatre espèces sont utilisées pour la magie ou la médecine traditionnelle, les plumes de six espèces servent d'ornements et dix espèces sont l'objet de superstitions. Les oiseaux sont importants dans le langage, avec des proverbes, des expressions, des dictons et des poèmes riches en noms d'oiseaux donnés localement. Les villageois d'Omi-aro et Labaka ont une relation forte avec les oiseaux, qui ont une signification culturelle et économique considérable pour eux. Des études ultérieures sur l'utilisation des oiseaux dans les pratiques de médecine traditionnelle ainsi que sur les méthodes de chasse et la saisonnalité de la chasse sont nécessaires pour améliorer la compréhension sur les prélèvements d'oiseaux correspondants.

Introduction

Ethno-ornithology, the study of birds in cultures, combines anthropological, cognitive and linguistic perspectives with natural science, in order to describe and interpret people's knowledge and use of birds (Tideman & Gosler 2010). Ethno-ornithological studies can improve the effectiveness of conservation and advance scientific knowledge, particularly of enigmatic forest birds in the tropics (Berkes 1999). Although local people are often considered as collaborators in environmental conservation, their traditional and local ecological knowledge is rarely incorporated into the management and protection of avifauna (Gilchrist *et al.* 2005). Over generations, indigenous peoples have accumulated knowledge in their interactions with the natural world, by conception, thought and experiment (Arbon 2008, Trafzer *et al.* 2008). This knowledge is culturally transmitted using symbols, narratives, rituals, music and dance (Toledo 1992).

In Nigeria, Adeola (1992) reported the importance of wild birds and their parts in the culture, religious festivals and traditional medicine while Dedeke *et al.* (2006) reported on the utilization of some birds in southwestern Nigeria. Soewu (2008) studied the uses of wild animals in ethno-zoological practices among the Yoruba people of southwest Nigeria, and their implications for conservation. Cocker (2000) and Nikolaus (2001, 2011) focused on bird exploitation for traditional magico-medicinal uses, and Cocker & Mikkola (2001) described the cultural responses to owls in Africa and their implications for conservation. Among West African countries, Nigeria leads in bushmeat consumption (Nikolaus 2011), and Cocker &

Mikkola (2000) noted that about a million birds from about 80 species are killed annually in West African countries like Benin, Ghana, South Africa, Togo and Nigeria for the fetish markets. According to Nikolaus (2011) several birds of prey are threatened with extinction due to the fetish culture in Nigeria.

Nigeria has about 940 species of bird (Clement 2000) and more than 650 local languages (Lewis *et al*. 2013).Therefore a great variety of knowledge about man–bird relationships might be expected in the different languages. The present study was carried out to explore this in Omi-aro and Labaka villages in Kwara State, western Nigeria.

Methods

The villages of Omi-aro and Labaka, in Ifelodun local government (8°32′22″N, 5°2′31″E), are located close to Ilorin, the capital of Kwara State (Fig. 1). The villages are in a rural setting with hills, scanty vegetation and forest patches, and with a river flowing through them. The region is inhabited mainly by Yoruba and Fulani peoples, occupied principally in hunting, fishing and farming.

Informants were selected based on the recommendations of the villagers, who identified some local people as experts with rich knowledge about animals. These experts acquired their knowledge mainly through oral information passed from their parents and from their personal interaction with nature, particularly through hunting and healing. Those regarded as the most experienced were selected as key informants, and altogether seven adult males were interviewed. All of the informants were Yoruba speakers.

Interviews were conducted from 30 March to 2 April 2013, between 17h00 and 19h00. A semi-structured questionnaire (Table 1) was employed to elicit responses from key informants as described by Martin (1995) and Maundu (1995). As the last three of the subjects in Table 1 did not elicit any positive replies, they are not considered further in this paper. To complement the interviews, a visual presentation including photographs of 21 species of birds common in Kwara State (listed in Results) was shown to the informants on a laptop computer for their comments. Photographs of the birds taken in Kwara State earlier in 2013 by WSW and NSP were used in the visual presentation, and the identity of the birds in the photographs has been verified by A. Tye (pers. comm.).

Yoruba is written using 21 letters of the English alphabet; the letters C, Q, V, X and Z are not used. The Yoruba alphabet also has four additional letters including two vowels (*Ẹ/ẹ* pronounced as English ER and *Ọ/ọ* pronounced as English OR, *i.e.* with the R not sounded in both cases) and two consonants (*GB/gb* as a G and B pronounced together, and *Ṣ/ṣ* pronounced as English SH). Yoruba tone marks are written above the vowels using three signs to represent three musical tones: low (DO), high (MI) and middle (RE). For example in the name *Àgbébọ̀* (Domestic Chicken), *À* and *ọ̀* are low tone, while *é* is high; an absence of mark above a vowel means it has middle tone.

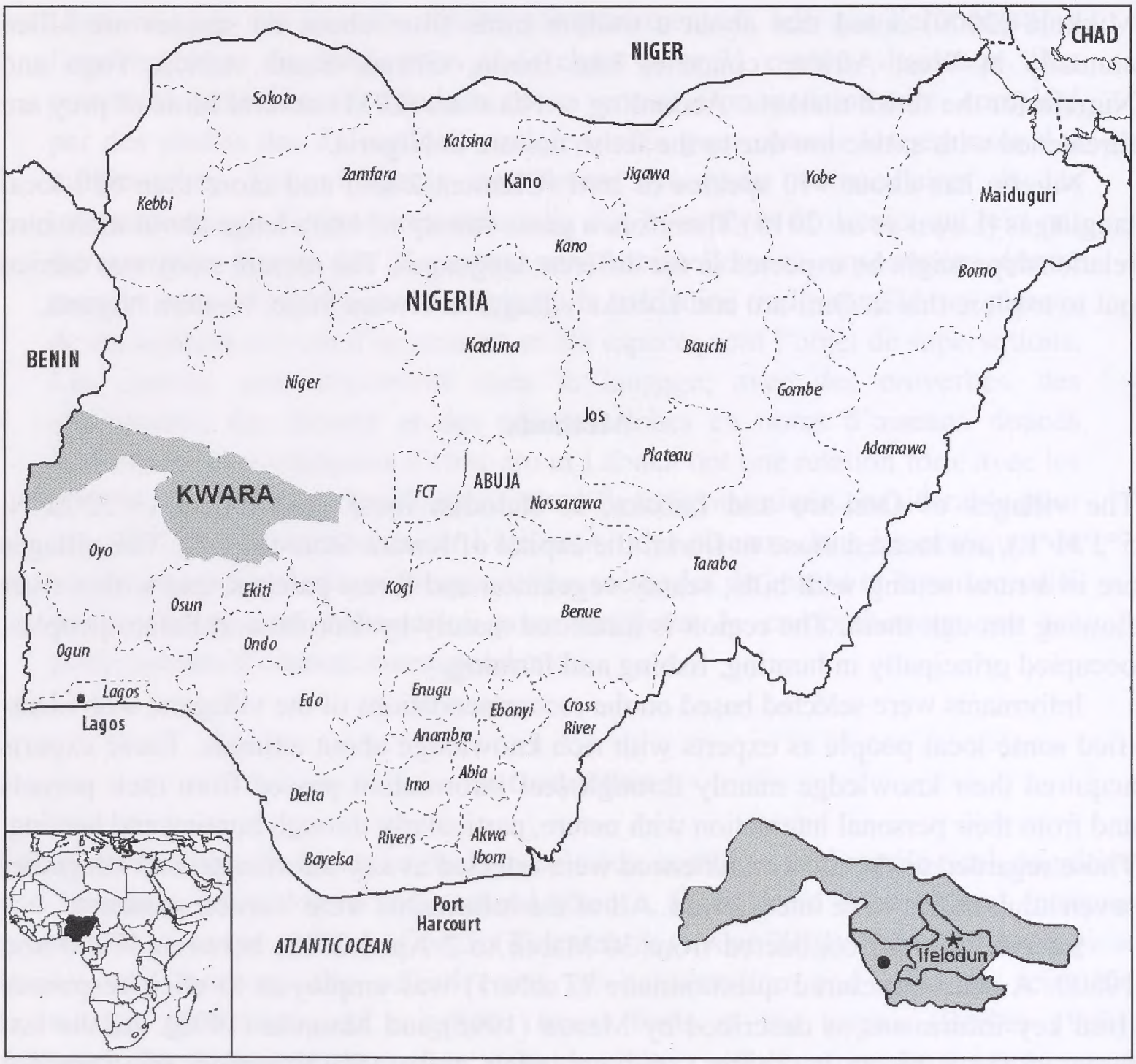

Figure 1. Map showing the location (the star) of the studied villages, Omi-aro and Labaka, in Ifelodun local government in Kwara State, Nigeria, and the location of the state capital city Ilorin (black dot).

Results

***Bubulcus ibis* Cattle Egret.** Known as *Lékeléke*; both meat and eggs are eaten. It is believed to have white feathers and black meat. Its feathers are used in the ceremony known as *Ìyá Ẹfun* which is literally translated as "white woman ceremony". This is celebrated annually to appease *Yemọja* (one of the River Gods or *Osun*), in which the women (*Osun* devotees) are dressed in white clothes and adorned with white feathers. During the ceremony, the *Osun* devotees so attired process through the streets each holding a Cattle Egret, after which they congregate in a shrine. After chanting prayers and panegyrics in praise of the River God, the birds are released. The Cattle Egret is related to the proverb *Lékèélékèé ló ni ẹfun*, which means that white belongs to the

Table 1. The subjects and specific questions included in the questionnaire of the ethno-ornithological study at Omi-aro and Labaka villages, Kwara State, Nigeria.

Subject	Questions
Vernacular name	What is the name of this bird?
Edibility	Are they edible? What is eaten in them? Eggs or meat?
Bird songs/calls	How does this bird sing? What is the meaning of its call?
Medicinal value	Which parts are used in any medicinal purposes and for what type of diseases?
Ornamental value	Do these birds have any ornamental value? How do you use them as ornaments?
Superstition	Do these birds have any associated superstition? What is the superstition?
Folklore	Are these birds connected to any folklore? What is the folklore of these birds?
Prediction	Do these birds have any predictive ability? What can these birds predict?
Egg laying	Where do they lay their eggs? How many eggs and what colour are they?
Nesting habits	Do these birds build nests? Where and what do they use in building their nest?
Value as pets	Do you use them as pets?
Pests of crops	Do these birds cause any damages to your crops? Which crops?
Diseases that they spread	Do these birds cause diseases?

Cattle Egret. This phrase is used to refer to anything that is pure white. The Cattle Egret is believed to call when danger is around. It is known to eat insects and ticks and to construct its nest of sticks in trees on the riverbank. Said to lay two eggs per year (fewer than the actual mean clutch size: Brown *et al.* 1982).

***Milvus migrans* Black Kite.** Known as *Àsá*; both meat and eggs are eaten. It is connected to the saying *Wọn gba òròmọdìẹ lọ́wọ́ ikú, ó ní wọn òjẹ́ kí òhun lọ àkìtaǹ lọ jẹ̀*, which means that although the chick [of the Domestic Chicken] is saved from the Black Kite it complains that it is not allowed to feed at the midden. This phrase is used when young people, after being saved or rescued from a dangerous pursuit, insist on their own rights to discover things or on doing the same again. The Black Kite is believed to call when it is hungry. It is known to make its nest with dry branches on the top of trees, to lay two eggs in a clutch, and to feed on animals that can be carried such as small birds, rodents, snakes and lizards, all of which is fairly accurate (Brown *et al.* 1982).

***Gyps rueppellii* Rüppell's Griffon Vulture.** Known as *Igun*; not eaten, and forbidden because, according to traditional lore, disaster may befall those who kill them. Vultures in general are known to congregate in large numbers to eat dead animals, and

are therefore believed to bring omens of death. They are connected to the saying *Igúnugún bà lé òrùlé, ojú tólé ojú tóko*, which means that when a vulture perches on the roof, it sees everywhere. This is used to insinuate that a person is watching everything. Another expression, *Ẹní pa gúnnugún kìí kádún*, means that a person who kills a vulture never lasts a year. This phrase is used when people believe that the death of someone was plotted by another. Feathers of vultures are taken for preparing a spell to be invisible which is known as *Òògùn* or *Àfẹ́ẹ̀rí*.

***Accipiter badius* Shikra.** Known as *Àwòdì*; both meat and eggs are eaten. It is connected to the proverb: *Àwòdì òkè kò mọ̀pé ará ilẹ̀ nwo òhun*, which means that the hawk does not know that people are watching. This phrase is used to refer to a person with evil plans, as the local people have a belief that those who have evil plans are revealed through their own actions. It is connected to the proverb *Òròmọdìẹ ò mọ àwòdì, ìyá ẹ ló mò àsá*, which means that a chick of the Domestic Chicken does not know the hawk but its mother does. This phrase is used to warn young people about dangers that may loom ahead. It is said to call when hungry and to feed on animals that can be carried such as small birds, rodents, snakes and lizards. It is said to predate on Domestic Chickens and Common Garden Bulbuls *Pycnonotus barbatus* too.

***Gallus gallus* Domestic Chicken.** The common name for both males and females is *Adìyẹ*, the rooster is *Àkùkọ*, the hen is *Àgbébọ̀* and the chicks are *Òròmọdìyẹ*; both meat and eggs are eaten. Although not completely revealed by the villagers, chicken meat is used with herbs for curing some sicknesses. The chicken is used as *Adìyẹ ìrànọ̀*, that is, to pave the way for the soul of the departed. A cleansing ritual is performed using a live chicken when a corpse is carried to the burial area. A son or a brother of the dead person will carry the "cleansing chicken" in front of the escort of the corpse, removing all feathers one by one and throwing them on the road. It is believed that the cause of the disease will follow the trail of feathers and may thus get buried with the dead person. The eating of the cleansing chicken is considered forbidden. Hence, the Domestic Chicken is related to the proverb: *Adìyẹ ìrannà kìí ṣe oun àjẹgbe*, which means that a cleansing chicken is not eaten without consequences. Another saying related to the chicken is: *Babaláwoló to ṣe àfeerí fún aayán ló se àrìnnàkò fún adìyẹ,* which means that a native witchcrafter who made a disappearing charm for a cockroach also provided a meeting charm for the chicken. This phrase is based on folklore: once, a cockroach went to the witchcrafter and appealed for a charm to protect it from the chicken. The witchcrafter made a disappearing charm and the cockroach disappeared whenever the chicken arrived. Realizing that it was impossible to catch the cockroach as usual, the chicken went to the witchcrafter. On the appeal of the chicken, the witchcrafter made a "meeting charm". With that, the chicken could catch the cockroach. This phrase is used when someone who caused a bad thing to happen made a good one happen too. Feathers of the Domestic Chicken are used in personal adornment by spiritualists and herbalists. The rooster calls in the early morning as *Kùkùrúùkú* and is said to give a special alert call when danger is around. The hen is known to have a specific call for the chicks especially when danger is

perceived and to show the chicks sources of food. It is known not to make nests but to lay eggs in concealed areas on the ground, or in dark spaces provided by their owners.
***Streptopelia senegalensis* Laughing Dove.** Has three names, *Àdàbà*, *Àtàbà* and *Òdèré-kókò*; both meat and eggs are eaten. It is considered to be gentle and therefore believed to be the source of gentleness, peace, fortune and love. It is attached to the phrase: *Oníwà tútú bí Àdàbà*, which means as gentle as a Laughing Dove. It is used for appealing for peace by sacrificing feathers. Its call "*Òdèré-kókò*" is interpreted as a laugh performed in the morning and afternoon. It is known to construct its nest with grass in tree branches, to lay two eggs per year, and to eat grains and seeds (*cf.* Urban *et al.* 1986).
***Centropus senegalensis* Senegal Coucal.** Known as *Ẹ̀lúlú*; both meat and eggs are eaten. It is important in traditional healing. It is also considered that it protects its nest from venomous snakes by sticking noxious animals like bees to the nest. It is used in rousing fortune (*Àwúre*) by sacrificing feathers, claws and beaks. Feathers of this bird are used in personal adornment by spiritualists and herbalists. It is said to construct a spacious nest, and is known to eat grasshoppers and snakes.
***Glaucidium perlatum* Pearl-spotted Owlet.** Known as *Òwìwí*; taboo to be eaten. It is considered forbidden for sacrifices due to the belief that this will bring disaster. Because it hunts at night, it is associated with witches and is referred to as a bird of witches. Its feathers are used in personal adornment by spiritualists and herbalists. It is said to build its nest in spacious holes in tree branches and trunks, abandoned buildings and cracks among rocks, and to lay two eggs per year, whereas this species normally only nests in trees, and clutch size can be 2–4 (Fry *et al.* 1988). It is believed to eat rabbits, rats and other small mammals, whereas this species takes mostly smaller prey than this but including some small mammals (Fry *et al.* 1988). However, we do not think that this lack of precision regarding biological characteristics indicates misidentification of the owl species, because in the study area there are only two common small owl species: Pearl-spotted Owlet and African Scops Owl *Otus scops*, with the former more often seen by day (WSW and NSP pers. obs.), and our studies in seven other states in Nigeria have consistently produced the same name for Pearl-spotted Owlet (unpubl. data).
***Halcyon leucocephala* Blue-breasted Kingfisher.** Known as *Akun o koyo*; not eaten. It is considered as the appeasement of the river goddess, since this bird resides near waterways. It is used in the *Ẹ̀rọ̀pẹ̀sẹ̀* practice in which it is sacrificed in order to gain relief from pain, stress and discomfort. It is believed to call when food is in the vicinity. It is said to make its nest near the river and to be fond of eating fish. Although this species is often found near water, it is primarily terrestrial and found in almost any bushland habitat; it rarely catches fish, and mostly eats grasshoppers (Fry *et al.* 1988). However, we have seen Blue-breasted Kingfisher near the river through the villages. There is a possibility that the villagers were confusing kingfisher species here, but only two large kingfishers, Blue-breasted Kingfisher and Woodland Kingfisher *H. senegalensis* are common in the area and both are primarily terrestrial. In some

neighbouring areas, Blue-breasted and Woodland Kingfishers are known by a single local name, whereas in others they are given different names (pers. obs. unpubl.).
***Coracias abyssinicus* Abyssinian Roller.** Known as *Ẹyẹ Òkin*; not known to be eaten. It is believed to excavate a hole in a tree branch as its nest, whereas this actually species uses pre-existing holes (Fry *et al.* 1988).
***Tockus nasutus* African Grey Hornbill.** Known as *Tìoko*; both meat and eggs are eaten. The skulls of hornbills are used in decorating hunters' homes to commemorate their hunting expeditions. Various body parts are used in the preparation of charms. Believed to bore holes in woody stems, make the lining of the nest with its feathers, then lay two eggs (whereas it actually uses existing holes, lines the nest with dry leaves and bark flakes, and lays 3–5 eggs: Fry *et al.* 1988) and remain there until the eggs are hatched. It is believed that the adult and chicks grow their feathers simultaneously and the feathered chicks and adult leave the nest together (whereas the female usually leaves first and the chicks reseal the nest for some days more: Fry *et al.* 1988). It calls *tìoko* at any time and the villagers do not link their vocalizations to any predictions, forecasting or other occurrence. Said to feed on grasshoppers, guinea corn and leaves, whereas true diet is insects and fruit (Fry *et al.* 1988).
***Lybius dubius* Bearded Barbet.** Known as *Ẹyẹ igbó*; both meat and eggs are eaten. Known to nest in pre-existing holes in tree trunks and branches.
***Dendropicos goertae* Grey Woodpecker.** Known as *Àkókó*; both meat and eggs are eaten. The head and the beak of this bird are sacrificed to the gods for the "money ritual" known as *Òògùn-Owó*, by which people expect to become rich. It is believed to make a *kokoko* sound while pecking a woody stem, (although this species in fact rarely drums: Fry *et al.* 1988), and to excavate a hole for its nest in tree trunks and branches. Because it makes holes in trees, it is favoured by witch doctors who prepare charms or jinxes (*Òògùn*), although we did not discover why. It connects to the expression: *Àkókó tó fi ẹnu kan Ògùn, Ọmọ ogun tiwa níí ṣe*, which literally means that when the woodpecker pecks the god of iron the followers' prayers will be answered. This means that when the woodpecker pecks a tree the deity of metal-works will answer the prayers of craftsmen such as blacksmiths. It is believed to eat insects in stems, and wood sap.
***Turdus pelios* African Thrush.** Known as *Àsósó*; not eaten due to small size. Said to use grass and mud to make its nest, to lay 3–4 eggs per clutch, and to eat insects including grasshoppers (fairly accurate in all respects: Urban *et al.* 1997).
***Turdoides plebejus* Brown Babbler.** Known as *Ọlọ́pẹ́ẹ̀rẹ́*; both meat and eggs are eaten. It is known to construct its nest with grass in tree branches, and to eat insects and fruit.
***Corvinella corvina* Yellow-billed Shrike.** Known as *Tìátìá*; not eaten due to its small size. It is used for witchcraft and in sacrifices for good luck and fortune. It is used in the superstitious practice known as *Àwúre* to improve fortune by sacrificing feathers, claws and beaks. It calls *tia tia* and is known to eat insects.
***Dicrurus adsimilis* Fork-tailed Drongo.** Known as *Sekúnṣẹ́*; not eaten. It is believed that it does not defecate directly on the ground but on other animals, and to call an

alarm when monkeys are around. It is known to construct its nest with grass in tree branches and to eat insects.

***Corvus albus* Pied Crow.** Known as *Kanokánó*; both meat and eggs are eaten. It is used in traditional healing practices and is believed not to lay eggs but to hatch from eggs of other birds. It is said to call to alert the other crows to the presence of food and danger. It is used in sacrifices for good luck and fortune (*Àwúre*), such as by sacrificing feathers, claws and beaks. Its feathers are used in personal adornment by spiritualists and herbalists. It is considered to eat palm fruits and eggs.

***Lamprotornis chloropterus* Lesser Blue-eared Glossy Starling.** Known as *Àrọ̀nì*; not eaten. It is used in traditional healing practices. It is believed that it has a supernatural power to disappear. It is known to be a hole nester using natural cavities in trees, and is regarded as *Ọba-ẹyẹ* which means the king of birds, because the nest is supposedly made to give so much comfort with a cushioned interior and grassy exterior. Although the nest hole may have only one entrance, the bird is said to disappear when danger arrives, therefore it is related to the expression: *Àrọ̀nì tó so igba òogùn mọ́yà, tó bá ko oníkọ̀là kiilẹ mọ́ bá ẹníbáníbẹ̀*, which literally means that the *Àrọ̀nì* with 200 charms tied on its neck disappears when danger arrives. Hence, the feathers are used in preparation of charms to make one invisible. It is used in sacrifices for good luck and fortune (*Àwúre*) by sacrificing feathers, claws and beaks. Feathers of this bird are used in personal adornment by spiritualists and herbalists. It is said to eat insects and flowers and to call *tintin*.

***Lamprotornis caudatus* Long-tailed Glossy Starling.** Known as *Yóríyórí*; both meat and eggs are eaten. Feathers taken from it are mixed with some herbal and animal products in the preparation of a spell to be invisible. It calls *keuheukeu,* and is known to eat insects and fruit.

***Ploceus cucullatus* Village Weaver.** Known as *Lankele*; both meat and eggs are eaten. Known to construct its nest with grass in tree branches, to lay two eggs per nesting attempt and to eat insects and fruit.

Discussion

The importance of birds to the indigenous people lies in their diet, superstitions, ornaments, healing systems, speaking (proverbs, idioms and wise sayings) and folklore, *i.e.* birds have economical, biomedical, ecological, aesthetic and socio-cultural importance.

Omi-aro and Labaka people had names for all 21 bird species shown to them. Some birds were given more than one name. The names derive from their behaviour, vocalizations, feeding patterns, habitats, physical features such as feather colours and shape of the beak, and habits, indicating that people closely observe the birds. Some of the birds are mainly identified by their vocalizations, and many Omi-aro and Labaka names are onomatopoeic, *e.g. Kanokánó* (Pied Crow), *Tìátìá* (Yellow-billed

Shrike), *Àkókó* (Grey Woodpecker), *Òdèré-kókò* (Laughing Dove) and *Tìoko* (African Grey Hornbill).

During the present study, photographs of birds in their natural habitats shown via a laptop computer resulted in obtaining all the local names and related information. Although Diamond & Bishop (1999) reported that New Guinea hunters mainly identified birds by size, voice, behaviour and posture (characteristics that are absent in two-dimensional pictures) and Kennedy *et al.* (2000) had mixed success in obtaining vernacular bird names by showing A4-size colour photographs and drawings, the Omi-aro and Labaka villagers were able to identify the bird photographs without any hesitation. It seems that they can readily and correctly identify most common species, as well as quickly provide information on bird uses, which are aspects of their day to day lives. But when asked about biological characteristics such as nesting habits, how many eggs, and nesting material, they sometimes became confused, and may never have considered those aspects before. Such biological information may be valuable for science, but not for the villagers.

Thirteen of the 21 bird species considered for this study were reported as being edible and both their meat and eggs are consumed. The utilization of birds as food reflects the existence of a bush-meat trade in Omi-aro and Labaka villages. Five bird species were not eaten due to their small size, and are considered as not having sufficient meat in their bodies. It is forbidden to kill the Pearl-spotted Owlet and vultures because, according to traditional lore, this may bring disaster to those who kill and eat them.

Four species among the 21 species in the study, namely Domestic Chicken, Senegal Coucal, Lesser Blue-eared Glossy Starling and Pied Crow, are important in magico-medicinal healing. The villagers were not willing to disclose exhaustive information about traditional healing practices, believing it might bring bad luck. Although it was not revealed completely due to the beliefs in witchcraft and wizardry, it is understood that body parts such as claws, feathers, beaks and organs such as liver, heart and blood are used for charms, traditional healing and during cultural activities. Further studies may reveal in depth information about the secrets of using birds.

Ten species among the 21 are deployed as objects of superstitions and ritualistic practices such as in sacrifices, charms and jinx. The birds of superstition are used as sacrificial tokens to various gods in order to obtain success, wealth, peace, hygiene and relief. Generally, the villagers use birds for six different rituals, namely *Adìyẹ ìrànọ̀*, *Àwúre*, *Ẹfun*, *Ẹ̀rọ̀pẹ̀sẹ̀*, *Òògùn Àfẹ́ẹ̀rí* and *Òògùn Owó*. Nikolaus (2001) reported the medical or other beneficial effects ascribed to bird species in Nigeria, among which Cattle Egret brings money and good luck, birds of prey help against weakness of the body, Hooded Vulture *Necrosyrtes monachus* brings good luck, large vultures help against mental disturbance, epileptic problems and bad eye sight, owls and Pied Crow provide protection from witchcraft, coucals and weavers bring blessing, rollers give beauty, hornbills give protection and security and woodpeckers improve business. Nikolaus (2011) reported the presence of 11 species (including

Cattle Egret, African Thrush, Yellow-billed Shrike and Village Weaver: common commodities in Omi-aro and Labaka villages) and ten groups of birds (including birds of prey, vultures, cuckoos and hornbills) in Nigerian fetish markets. Soewu (2008) reported Black Kite, Cattle Egret, Harrier Hawk, Pied Crow, Hooded Vulture *Necrosyrtes monachus*, Barn Owl *Tyto alba,* Red-eyed Dove *Streptopelia semitorquata* and Greater Blue-eared Glossy Starling *Lamprotornis chalybaeus* in the markets in Ogun State, Nigeria. According to Soewu (2008) vultures are related to several aspects of superstitious belief such as protection against evil influences, manipulation, fertility for women, appeasing witches and seeking marital partner, while owls are fortune improvers and preventers of accidents. Cocker (2000) particularly described the man–owl relationship in West Africa, noting that owls are deeply feared as omens of ill health, death and bad luck. According to Cocker & Mikkola (2001) owls are killed mainly for superstitious beliefs to avoid bad luck and to make (magic) medicine, but also to avoid their noise, for sport hunting and to be eaten as a relish. Cocker (2000) considered this a serious cultural challenge to the conservation of owls in Africa. Throughout the African continent there is a complex, varied, sometimes contradictory body of beliefs and mythology about the family Strigidae, of which many species are threatened (Cocker & Mikkola, 2001).

Six species of the 21 were used in ornamentation, with feathers the most important body part so used. Feathers of the Senegal Coucal, Pearl-spotted Owlet, Pied Crow and Lesser Blue-eared Glossy Starling are used in personal adornment by spiritualists and herbalists (*Babaláwo*).

Nine of the 21 species are related to wise sayings, quotes, proverbs and idioms, which are derived mainly from characteristics of the birds. The villagers predict future events based on the behaviour of some birds.

Local knowledge about behavioural characteristics such as habitat selection for nesting, material used in construction of nests, methods of lining the interior and egg laying was considerable but not always accurate. For example, the clutch sizes and food of several species differ from those indicated by the informants. Despite this, their traditional knowledge can be used to promote conservation of birds if wisely used. For example, this kind of information can be used in conservation awareness programmes, by incorporating folklore, wise sayings and folk poems into posters and leaflets, in order to praise and appreciate the villagers for protecting both birds and ethno-ornithological knowledge. These materials can be blended with valuable scientific information or conservation messages, such as information about the conservation status of birds and the reasons for their declines, and ways to protect them.

Bush-meat, including birds, can contain more protein than meat from domestic animals (sheep, pigs) (Malaisse & Parent 1982), and wildlife hunting is encouraged by the high prices of these animals, which have led hunters to maintain a supply from ever-decreasing wildlife populations (Okiwelu *et al.* 2009). According to Fa *et al.* (2006) birds make up a small proportion of the bush-meat for sale in markets in southern Nigeria, but smaller birds are often consumed by hunters and their families

rather than traded (Fa & García-Yuste 2001). On the other hand, Nikolaus (2001) reported a strong demand for some birds in fetish activities in Nigeria, and Cocker (2000) reported about 80 species of birds in fetish markets in West African countries, including Cattle Egret, Black Kite, Shikra, Pearl-spotted Owlet, Senegal Coucal, Abyssinian Roller, African Grey Hornbill, Bearded Barbet, Grey Woodpecker, African Thrush, Brown Babbler and Pied Crow, which were found to be killed in Omi-aro and Labaka villages too. Although Laughing Dove, Long-tailed Glossy Starling and Village Weaver were not recorded by Cocker (2000) in fetish markets, Omi-aro and Labaka villagers eat them and use them for superstitious practices, indicating that market surveys alone do not provide a complete picture of bird uses.

A number of species that appear to be seriously affected by habitat loss, or other threats including pesticides, feature strongly in traditional African medicine, such as owls and hornbills (Cocker 2000), or are widely hunted for sale for other purposes (Nikolaus 2011). Quantifying the economic value of birds at the village level could contribute to national scale evaluation of bird use and assist in planning bird conservation.

Understanding how indigenous peoples view the world, and how their knowledge is generated, owned and recorded, is important to understand and appreciate local perspectives on creatures such as birds (Medin & Atran 1999), and therefore it is hoped to build on this preliminary study as a platform for further research. There is an urgent need to document systematically the uses of birds in indigenous communities, because the old folks are usually the custodians of such information and, with the rapid disappearance of traditional cultures and natural resources arising from urbanization and industrialization, such information could be lost forever (Igoli *et al.* 2005). Such knowledge may be beneficial for health care, ecological management, and biodiversity conservation. Conservation of birds and their habitats can be promoted by demonstrating these values to the public as well as to policy makers. The interest of the Omi-aro and Labaka people in birds, and the value of many bird species to them and in traditional conservation ethics, could provide a sound basis for conservation action at the local level, especially if better understood.

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Seasonal variation in the breeding ecology of three cooperatively breeding bird species on the University of Ghana Campus, Legon

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Summary

As one of the few "green areas" left in the rapidly expanding city of Accra, the Legon Campus of the University of Ghana is a key refuge for birds including three sympatric cooperative breeders: Yellow-billed Shrike *Corvinella corvina*, Green Wood-hoopoe *Phoeniculus purpureus* and Brown Babbler *Turdoides plebejus*. Amidst rapid destruction of habitats and associated bird declines in the Accra plains, this study compares the ecology of these three species during the dry and wet seasons, including variation in territory distribution and size, group and clutch size, and food provisioning rate. The Yellow-billed Shrike was the most abundant species, with more territories and larger groups than Brown Babbler and Green Wood-hoopoe. Territory size in the two seasons averaged 1.15 ± 0.57 ha (wet, n = 27) and 1.27 ± 0.50 ha (dry, n = 31) for Yellow-billed Shrike, 2.00 ± 0.84 ha (wet, n = 11) and 2.46 ± 0.86 (dry, n = 8) for Brown Babbler, and 4.15 ± 1.80 ha (wet, n = 14) and 3.92 ± 1.50 (dry, n = 14) for Green Wood-hoopoe, whereas group size across the two seasons was respectively 9.1 ± 3.4, 8.5 ± 3.3, and 7.0 ± 3.4, suggesting an inverse inter-specific relationship between territory size and group size. Seasonal variation in territory and group sizes among the three species was not significant. For Yellow-billed Shrike only, clutch size per group member and food provisioning rate per group member were both significantly higher in the dry than the wet season. Despite the many new buildings constructed on the Legon Campus in recent years, populations of the three cooperative breeders appear resilient to the disturbances, which we attribute to the fact that the campus maintains high tree cover and habitat heterogeneity, both of which ought to be recognised in future management of this important area for birds.

Résumé

Variation saisonnière dans l'écologie de la reproduction coopérative de trois espèces d'oiseaux sur le Campus de l'Université du Ghana, Legon. L'une des rares "zones vertes" épargnées par la rapide croissance de la ville d'Accra, le Campus de Legon de l'Université du Ghana est un refuge-clé pour les oiseaux, incluant trois espèces dont la reproduction est coopérative: la Corvinelle à bec jaune *Corvinella corvina*, l'Irrisor moqueur *Phoeniculus purpureus* et le Cratérope brun *Turdoides plebejus*. Dans un contexte de destruction rapide des habitats et de déclin consécutif des oiseaux dans les plaines d'Accra, cette étude compare l'écologie de ces trois espèces pendant les saisons sèche et humide, dont les variations dans la distribution et la taille des territoires, la taille du groupe et de la couvée ainsi que le rythme d'alimention des oisillons. La Corvinelle à bec jaune était l'espèce la plus abondante, avec des territoires plus étendus et des groupes plus importants que le Cratérope brun et l'Irrisor moqueur. La surface du territoire au cours des deux saisons a été en moyenne de 1.15 ± 0.57 ha (humide, n = 27) et 1.27 ± 0.50 ha (sèche n = 31) pour la Corvinelle à bec jaune, de 2.00 ± 0.84 ha (humide, n = 11) et 2.46 ± 0.86 (sèche, n = 8) pour le Cratérope brun et de 4.15 ± 1.80 ha (humide, n = 14) et 3.92 ± 1.50 (sèche, n = 14) pour l'Irrisor moqueur, tandis que la taille des groupes pendant les deux saisons était respectivement de 9.1 ± 3.4, 8.5 ± 3.3, et 7.0 ± 3.4, ce qui suggère une relation interspécifique inverse entre la dimension du territoire et la taille du groupe. Les variations saisonnières entre dimension du territoire et taille du groupe n'étaient pas significatives pour les trois espèces. Pour la Corvinelle à bec jaune seule, le nombre d'œufs dans la couvée per capita des adultes et le rythme d'alimentation des oisillons per capita des adultes étaient significativement plus élevés en saison sèche qu'en saison humide. En dépit des nombreuses nouvelles constructions édifiées sur le Campus de Legon au cours des dernières années, les populations des trois espèces dont la reproduction est coopérative apparaissent résilientes aux perturbations, ce que nous attribuons au fait que le campus conserve une bonne couverture arborée et hétérogéneité d'habitats, qui toutes deux devraient être maintenues dans la gestion future de cette zone importante pour la conservation des oiseaux.

Introduction

Cooperative breeding in birds is a complex social behaviour by which offspring at one nest are reared by more than two birds (Emlen & Vehrencamp 1985, Arnold & Owens 1998). This breeding system is practised by about 9% of bird species globally, particularly in the tropics (Koenig & Dickinson 2004, Cockburn 2006, Gill 2007).

Commonly, there is a dominant breeding pair in the social unit, while subordinate birds act as "helpers at the nest" (Cockburn 1998). Such apparently altruistic behaviour (Hatchwell 2009) could result from avoidance of inbreeding which might otherwise be caused by delayed or limited dispersal (Nelson-Flower *et al.* 2012). Benefits of cooperative breeding may include increased clutch size, increased offspring survival resulting from enhanced food provisioning rate (e.g. Wright 1998), improved intraspecific territory defence (e.g. Monadjem *et al.* 1995), and better defence and surveillance against predators (Anava *et al.* 2001), kleptoparasites (Ridley & Raihani 2007) and brood parasites (Feeney *et al.* 2013). On the other hand, this breeding system appears to have negative implications for subordinate non-breeders in the form of delayed reproduction and increased intraspecific competition for food and nesting sites (Pen & Weissing 2000).

Several evolutionary hypotheses, not necessarily mutually exclusive, have been suggested to account for this. Helpers may gain through raising genetic relatives, while unrelated helpers may benefit by receiving future assistance (Wright 1998, Nelson-Flower *et al.* 2011). Low annual mortality may restrict opportunities for obtaining breeding territories (Arnold & Owens 1998, Hatchwell & Komdeur 2000) so birds may stay to help, perhaps until they can inherit a territory (Monadjem *et al.* 1995, Cockburn 1998, Gill 2007, Raihani *et al.* 2010). Environmental variability and unpredictability may drive cooperative breeding, particularly in semi-arid habitats and deserts (Rubenstein & Lovette 2007, Jetz & Rubenstein 2011). Non-breeding helpers should remain only when there is a net fitness benefit in doing so, which is most likely when territories vary greatly in quality or when cooperation leads to high variance in fitness between individuals in different-sized groups (Stacey & Ligon 1991, Raihani *et al.* 2010). Some cooperative breeding systems may have evolved as a response to high levels of brood parasitism, particularly in sub-Saharan Africa and Australasia (Feeney *et al.* 2013).

In the face of the rapid expansion of the Accra metropolis, many habitats within the Accra plains are disappearing. The Legon Campus of the University of Ghana is one of the few remaining "green areas", where almost 150 bird species are recorded (LHH pers. obs.), including three cooperatively breeding birds: Yellow-billed Shrike (YS), Green Wood-hoopoe (GW), and Brown Babbler (BB). Whereas detailed studies on the YS have been conducted over a period of some 30 years (Grimes 1980, 2006b), the breeding ecology of the two other species remains largely unstudied in West Africa, although the GW has been intensively studied in eastern and southern Africa (e.g. Ligon & Ligon 1978, Ligon *et al.* 1988, Stacey & Ligon 1991, Du Plessis & Williams 1994, Radford & Du Plessis 2004).

In line with the explosion of the student population at the University of Ghana (*c.* 29,750 in 2014, compared to 2360 in 1971–2), many environmental changes have occurred on the Legon Campus and its environs since the 1970s. Since 2000, many green areas around and within the campus have been built up (Grimes 2006a, Gbogbo & Awotwe-Pratt 2008, Garshong *et al.* 2013). Even though the increase in student

numbers was highest between 2001 and 2002 (*c.* 8000), compared to the 10-year period from 2003 (*c.* 5000), much more building, and hence damage to the environment, has taken place since 2005. This includes a stadium, four new halls of residence, a Public Health School and a still incomplete Medical School complex, all of which are located in the southeastern part of the campus. Other developments within this period include the construction of several religious facilities and a sewage treatment plant (in 2010–12), replacing 15 ha of thicket and shrubland next to the Botanical Gardens and Agricultural Research Station.

These changes have been implicated in modifications of the bird community on the campus, with declines in several species, while others remained constant or increased significantly (Grimes 2006a, Gbogbo & Awotwe-Pratt 2008, Annorbah & Holbech 2012). We present ecological data on the three cooperative breeders, including the spatial and temporal dynamics of territory number and size, group size, clutch size and food provisioning rates. Seasonal variation in these aspects may be related to environmental factors such as food availability (*e.g.* Radford & Du Plessis 2004, Golabek *et al.* 2012), and we therefore hypothesised that the rainy season may increase prey abundance (arthropods) for all three species, and thus influence their breeding success (Lepage & Lloyd 2004, Williams & Middleton 2008). The information obtained provides additional insight into the variation in the cooperative breeding systems of these and other birds (Cockburn 2006, Hatchwell 2009), as well as informing the conservation and management of the avifauna at Legon.

Study area

The Legon Campus of the University of Ghana (5°39′03″N, 0°11′13″W) encompasses *c.* 1300 ha and lies *c.* 13 km northeast of Accra, the capital of Ghana, at an altitude of 90–120 m. The annual precipitation ranks among the lowest in the southern part of the country, ranging from 733 mm to 1118 mm (Decher & Bahian 1999), and the rainfall pattern is erratic and bimodal with a major rainy season in May–July and a minor peak in September–October (Grimes 1980). In the northern corner of the campus, the Botanical Gardens covers *c.* 25 ha, characterised by grasslands, shrubland and gallery forest with large forest trees such as Silk Cotton *Ceiba pentandra* and Antiaris *Antiaris toxicaria*. There are also cash crops like Mango *Mangifera indica* and Coconut *Cocos nucifera*, and a large collection of West African orchids and palms. The southern part of the campus consists mainly of built-up areas comprising educational facilities and residences, but also a variety of interspersed habitats, including small farms, grasslands, bamboo thickets, avenue trees (e.g. *Khaya senegalensis*, *Erythrophleum* sp., *Millettia thonningii*), woodlands including Neem *Azadirachta indica*, and a small Teak *Tectona grandis* plantation. A more detailed description of the campus may be found in Grimes (2006a).

Methods

During an initial census period of the study, Jun–Aug 2012, group territories of the three bird species were identified and numbered, by surveying the campus during the day, including the early morning and late afternoon hours when birds gather around their nests. Individuals of each of the three bird species were considered to form a territorial group if the area they inhabited had an actively defended nest during this census period (Ligon & Ligon 1978, Grimes 1980, 2006b). The methods used to determine territorial group sizes followed those described by Grimes (1980). Nest sites were located by following birds returning with food for the breeding female and offspring (Radford & Du Plessis 2004), or by finding the source of food-solicitation calls produced by breeding females (Ligon & Ligon 1978). Groups of birds associated with each territory were observed for 30–45 min. each over several days during which repeated counts were made to determine accurately the number of individuals in the group.

In order to evaluate seasonal variation in territory number and size, group size, clutch size and food provisioning rates, these variables were estimated during the following wet (Sep–Oct 2012) and dry (Jan–Feb 2013) seasons, by means of group-unit observations, rather than observations of the behaviour of particular individuals. We deemed it therefore unnecessary to colour-ring each group member.

To demarcate the territorial boundaries, movements of group members were observed using the spot mapping method (Bibby *et al.* 2000), with a focus on locations where disputes arose between different groups (Grimes 1980, Monadjem *et al.* 1995). The observations were done for *c.* 3–4 h for each territory during both wet and dry seasons. During each observation period, the bird group was followed quietly and positions distant from the nest were recorded with a portable Global Positioning System receiver (Garmin eTrex) and plotted on a detailed digitised map of the campus. Changes in the location of the birds within the observation periods were also noted and the geographical coordinates recorded accordingly. For each nesting group the five coordinates recorded most distantly from the nest were used to define the minimum territory limits, following the minimum convex polygon (MCP) method (Powell 2000, Shaw *et al.* 2003) using Quantum GIS software (QGIS version 1.8.0 Lisboa plugin, Animove for SEXTANTE version 1.3.3: <http://www.qgis.osgeo.org>) constrained so that the MCPs included all five of the coordinates. This method suffers from the disadvantage that the five furthest points may not define the full extent of the territory if birds did not visit some areas of their territory often, or did not go far from the nest to one side of their territory so that none of the five furthest points fell to that side. This was evident from the fact that in some cases the nest itself fell outside the MCP defined by the five most distant points from it, in which case the nest site itself was added as a sixth point, to define the boundaries. This resulted in MCPs with 3–6 sides. The territory sizes of each group in both seasons were estimated by this method.

The clutch sizes of all nesting groups were determined by counting eggs, nestlings or fledglings. Clutch sizes of the YS and BB were determined from eggs or nestlings

observed directly with the use of an angled inspection mirror on a 3-m stick. The egg-laying of each nesting group was monitored daily or every other day for up to three weeks. The clutch size was determined after ensuring that no additional eggs were laid, when all eggs including some nestlings were finally counted and recorded. However, due to extreme agonistic behaviour directed towards the observer, and the profound persistence of the breeding birds in guarding the nest after hatching, we experienced difficulties in counting nestlings with accuracy. As we did not want to interfere with breeding behaviour, the numbers of hatched eggs could not always be recorded, and hatching success was therefore not assessed. Since nests of the GW were placed high up (> 5 m) in tree cavities, their eggs and nestlings could not be seen and the number of fledglings was counted after hatching. The different methods used for each species are considered acceptable, since these data were used only for intraspecific, inter-seasonal comparisons.

According to Wright (1997), food provisioning to broods and breeding females of cooperatively breeding bird species is high during the early morning and late afternoon. Therefore, the frequency with which group members brought food to the nest was monitored during the periods 6h00–9h00 and 15h00–18h00; these observations lasted typically 3 h per day during 2–5 days per species (6–15 h total per species), depending on weather and our ability to detect foraging groups. To reduce disturbance, observations were made from 10–30 m distant from the nest (Wright 1997), using 10×40 binoculars. Not all breeding groups could be studied with regards to food provisioning rate; the selection of nests depended on how visible the nest was from the relatively distant observer, and numbered from 2–5 groups in the different species (Table 1).

For each species and season, the group-based means, calculated as $(\sum x_n)/n$, where x = value of variable assessed for each group and n = number of groups monitored, and standard deviations were calculated for nine variables: group size (G_N), breeding group size (G_B), non-breeding group size (G_{NB}), size of groups studied for food provisioning (G_{BF}), territory size (T), clutch size (C), per capita clutch size (C/G_B), food provisioning rate (F = feeding visits/h) and per capita food provisioning rate (F/G_B). Per capita clutch size is a measure of how efficient groups are in producing and maintaining offspring. Similarly, per capita food provisioning rate indicates how much group members contribute on average to feeding the offspring and breeding female, but does not identify each member's contribution (which would require individual recognition by *e.g.* colour ringing). Each of these data sets was tested for normality using tests for kurtosis and skewness. Since all data sets were non-normal, the seasonal variation (dry *vs* wet) in five variables (G_B, C, C/G_B, F, F/G_B) and comparisons between group sizes were tested with non-parametric Mann-Whitney U tests, while seasonal variation in G_N and T was tested with Wilcoxon's Signed-rank tests. The percentage of groups that bred (B/N %) was compared across the two seasons for each species and tested for statistical difference with a χ^2 test. The relationships between group and territory size, group and clutch size, and group size and food provisioning rate, were tested for significance of the best-fit (linear or

lograrithmic) regression lines (which are shown in Figs 4–7), using GLM and non-linear regression with Pearson correlation coefficients. All statistical analyses were performed with Practistat® software (Ashcroft & Pereira 2003) and Microsoft Excel.

Results

Group number, territory distribution and size

The number of group territories showed little variation between the two periods (wet *vs* dry) for all three species (Table 1). Territories of YS and GW tended to have a higher density in the central part of the campus where building density was highest (Figs 1, 2), and GW territories were also generally associated with wooded areas containing lots of tall old trees with dead branches, loose bark and cavities. Two of the GW territories that were unoccupied during the dry season had nest sites under roofs. BB territories were widely distributed with no particular preference for central or peripheral portions of the campus (Fig. 3).

YS displayed the smallest mean territory size and GW the largest, with BB territories in-between (Table 1). The difference between the seasonal means was not statistically significant for any of the three species (Table 2).

Group size and population data

The highest average group size (G_N) in both the wet and dry seasons was for the YS, with GW having the smallest group sizes (Table 1). The mean group sizes were statistically similar across the two seasons for all three species. The YS recorded a significantly higher proportion of breeding groups (B/N) in the dry season compared to the wet season, whereas GW and BB showed no significant seasonality in breeding (Tables 1, 2). In all three species and in both seasons, the mean size of breeding groups (G_B) was not significantly different from that of non-breeding groups (G_{NB}) (Tables 1, 3).

We estimated the populations of the three species over the two seasons by adding up the group members (excluding nestlings) in all groups detected, and calculated densities by dividing these totals by the *c.* 350 ha study area; the YS displayed the highest abundances and densities of the three species (Table 4).

Clutch size and number of fledglings

The mean clutch size of YS during the dry season was significantly higher than during the wet season, and in the BB and GW, clutch sizes were also higher in dry compared to wet seasons but the differences were not significant (Tables 1, 2). Similarly, the per capita clutch size (C/G_B) was significantly higher in the dry season for the YS, and was also higher then, but not significantly so, for the BB (Tables 1, 2). The per capita number of fledglings of GW was the same in both seasons. These results suggest that the dry season is more favourable for the breeding of all three species.

Figure 1. Map of Yellow-billed Shrike territories during wet and dry seasons at the Legon campus, 2012–13.

Figure 2. Map of Green Wood-hoopoe territories during wet and dry seasons at the Legon campus, 2012–13.

Figure 3. Map of Brown Babbler territories during wet and dry seasons at the Legon campus, 2012–13.

Table 1. Ecological variables (means ± SD) for three cooperative breeders in two seasons at the Legon Campus. The percentages are of groups that bred in a particular season out of the total number of groups (N) recorded in that season.

	Yellow-billed Shrike		Green Wood-hoopoe		Brown Babbler	
	Wet	Dry	Wet	Dry	Wet	Dry
Total groups (N)	27	31	11	8	14	14
Breeding groups (B)	7 (26%)	15 (46%)	4 (36%)	3 (38%)	2 (14%)	3 (21%)
Groups studied for provisioning (B_F)	3	5	4	3	2	3
Overall group size (G_N)	9.1 ± 3.5	9.1 ± 3.4	6.7 ± 3.3	7.4 ± 3.8	8.6 ± 3.5	8.5 ± 3.2
Breeding group size (G_B)	9.4 ± 2.5	8.0 ± 2.3	7.8 ± 3.0	8.3 ± 1.5	10.5 ± 3.5	10.0 ± 4.6
Non-breeding group size (G_{NB})	9.0 ± 3.8	10.1 ± 4.0	6.1 ± 3.5	6.8 ± 4.8	8.3 ± 3.5	8.1 ± 2.9
Size of groups studied for provisioning (G_{BF})	10.3 ± 2.1	6.2 ± 1.3	7.8 ± 3.0	8.3 ± 1.5	10.5 ± 3.5	10.0 ± 4.6
Territory size (T, ha)	1.15 ± 0.57	1.27 ± 0.50	4.15 ± 1.80	3.92 ± 1.50	2.00 ± 0.84	2.46 ± 0.86
Clutch size (C)	1.7 ± 0.8	3.5 ± 1.1	2.8 ± 1.0*	3.3 ± 0.6*	2.5 ± 0.7	3.3 ± 0.6
Per capita clutch size (C/G_B)	0.2 ± 0.1	0.5 ± 0.2	0.4 ± 0.1	0.4 ± 0.1	0.2 ± 0.0	0.4 ± 0.2
Food provisioning rate (F)	19.2 ± 3.7	16.5 ± 3.8	26.8 ± 5.9	27.0 ± 6.0	19.5 ± 3.7	20.1 ± 5.0
Per capita provisioning rate (F/G_B)	1.9 ± 0.4	2.8 ± 0.8	3.8 ± 1.2	3.3 ± 0.9	2.0 ± 0.6	2.2 ± 0.7

*"Clutch size" = number of fledglings, because eggs and nestlings could not be counted.

Table 2. Comparison between seasons of ecological variables in Table 1. Significant seasonal differences are shown in bold.

	Yellow-billed Shrike	Green Wood-hoopoe	Brown Babbler
% Breeding groups (B/N %)	**$\chi^2 = 5.556$, $P = 0.0184$**	$\chi^2 = 0.054$, $P = 0.816$	$\chi^2 = 1.400$, $P = 0.237$
Overall group size (G_N)	$z = 0.698$, $P = 0.485$	$z = 0.202$, $P = 0.840$	$z = 0.042$, $P = 0.967$
Breeding group size (G_B)	$U = 70.0$, $P > 0.05$	$U = 6.5$, $P > 0.05$	$U = 3.0$, $P > 0.05$
Non-breeding group size (G_{NB})	$U = 193.0$, $P > 0.05$	$U = 18.5$, $P > 0.05$	$U = 67.0$, $P > 0.05$
Size of groups studied for provisioning (G_{BF})	$U = 15.0$, $P = 0.05$	$U = 6.5$, $P > 0.05$	$U = 3.0$, $P > 0.05$
Territory size (T)	$z = 1.937$, $P = 0.0527$	$z = 1.085$, $P = 0.278$	$z = 1.397$, $P = 0.162$
Clutch (or brood*) size (C)	**$U = 95.5$, $P < 0.05$**	$U = 8.5$, $P > 0.05$*	$U = 5.0$, $P > 0.05$
Per capita clutch size C/G_B	**$U = 95.5$, $P < 0.05$**	$U = 7.0$, $P > 0.05$	$U = 4.0$, $P > 0.05$
Food provisioning rate (F)	$U = 91.0$, $P > 0.05$	$U = 55.5$, $P > 0.05$	$U = 29.5$, $P > 0.05$
Per capita provisioning rate (F/G_B)	**$U = 113.5$, $P < 0.05$**	$U = 71.0$, $P > 0.05$	$U = 31.0$, $P > 0.05$

Table 3. Comparison between size of breeding (G_B) and non-breeding (G_{NB}) groups, in the two seasons.

	Yellow-billed Shrike	Green Wood-hoopoe	Brown Babbler
Dry season	$U = 159.5, P > 0.05$	$U = 10.0, P > 0.05$	$U = 21.0, P > 0.05$
Wet season	$U = 86.0, P > 0.05$	$U = 18.5, P > 0.05$	$U = 17.0, P > 0.05$

Table 4. Summary population data for the three cooperative breeders in the present survey and, for Yellow-billed Shrike, compared with those estimated by Grimes (1980, 2006a). The ranges indicate estimates for the wet and dry seasons respectively.

	2012–13			Grimes YS	
	YS	GW	BB	1970s	2004
N Groups	27–31	8–11	14	23–25	33
Group size	9.1	6.7–7.4	8.5–8.6	12	9
Territory size	1.15–1.27	3.92–4.15	2.00–2.46	16.6	–
Population	246–282	54–81	119–120	276	297
Birds/ha	0.7–0.8	0.15–0.23	0.35	0.8	0.9

Group size and clutch size were not positively correlated for any of the three species. However, the YS showed a significant negative correlation between per capita clutch size and group size in the dry season and for the whole year in general (Fig. 4).

Food provisioning rates

Food provisioning rate (h^{-1}) of the YS was higher in the wet than in the dry season (though not significantly so), whereas the GW and BB showed no difference (Tables 1, 2). However, the per capita food provisioning rate (h^{-1}.adult $^{-1}$) for YS was significantly higher in the dry than in the wet season, whereas GW and BB showed no significant

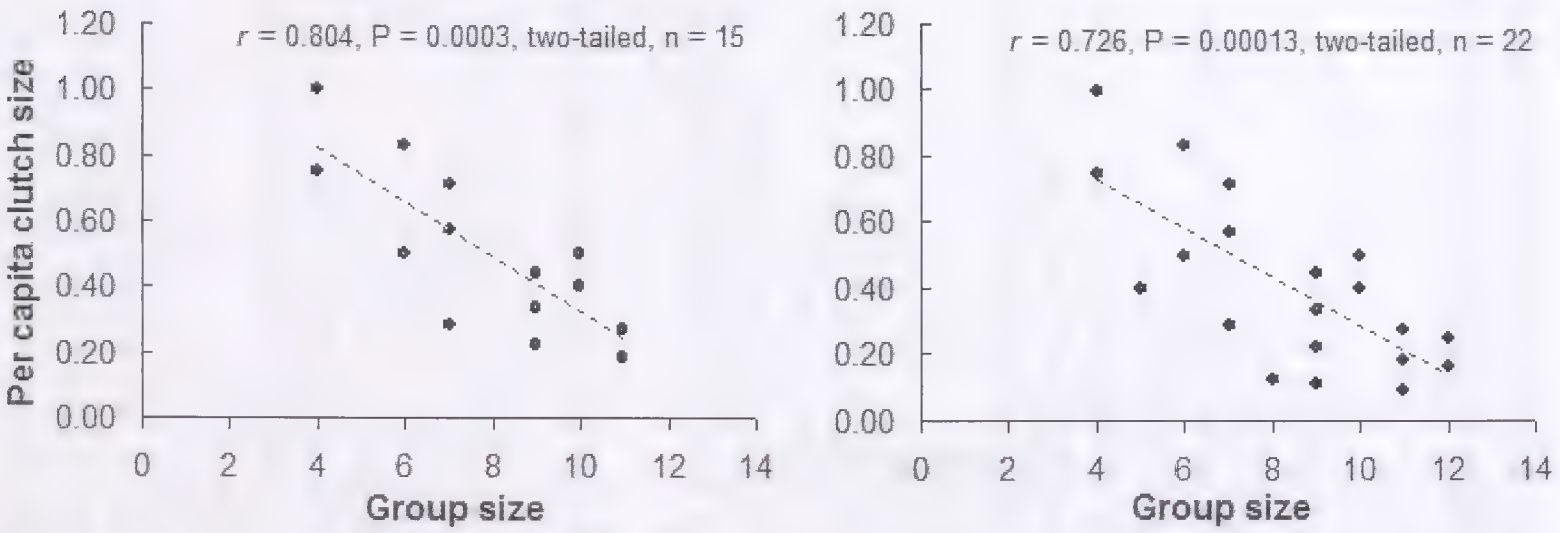

Figure 4. Correlation between per capita clutch size (C/G_B) and group size for the Yellow-billed Shrike in the dry season (left) and the whole year (right).

variation in this regard (Tables 1, 2). Thus for the YS, overall food provisioning to nests was lower in the dry season but on average each adult had to contribute more; this was because the groups monitored for food provisioning were smaller in the dry season (G_{BF}, $P = 0.05$, Tables 1, 2) and the per capita clutch sizes were higher in that season. Seasonal food provisioning rates for GW and BB showed no clear differences.

Territory size and group size

For the YS, group size and territory size were positively correlated in both wet and dry seasons (Fig. 5). In contrast, the GW and BB showed no significant trends in the relationships between group and territory size. When comparing all three species, there was a significant negative correlation between group and territory size (Fig. 6).

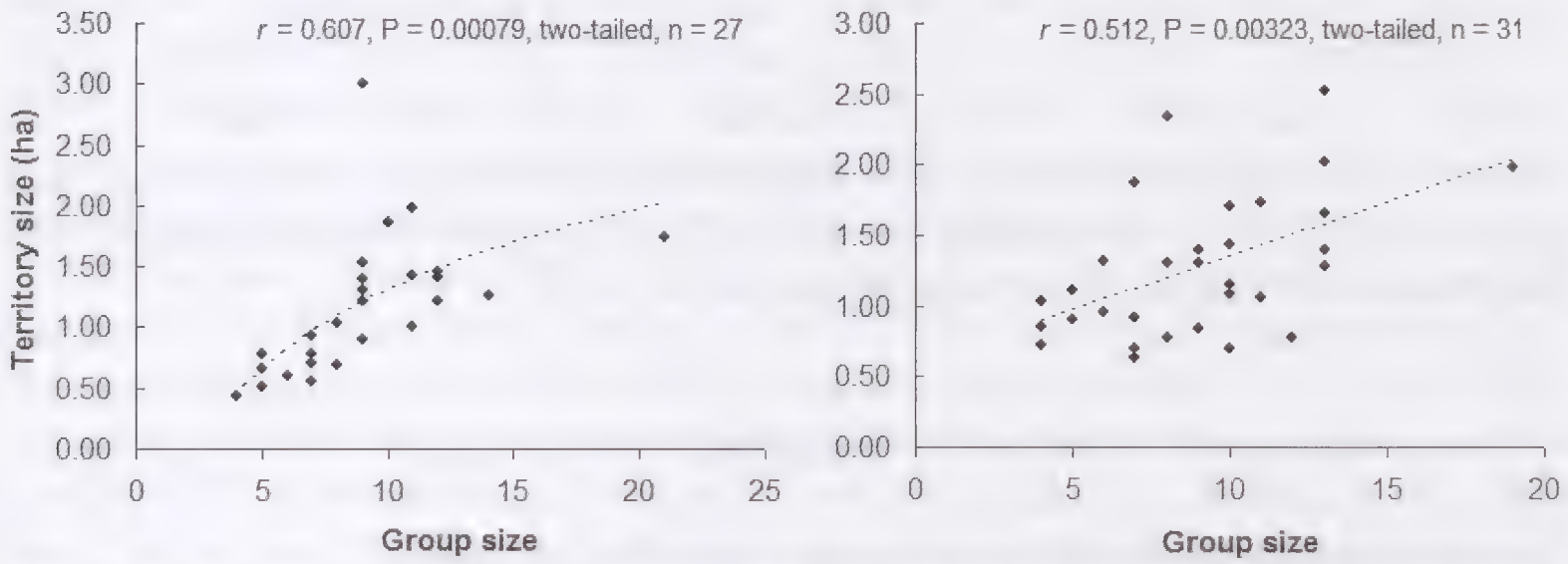

Figure 5. Correlation between territory size and group size for the Yellow-billed Shrike in the wet (left) and dry (right) seasons, at the Legon campus, 2012–13.

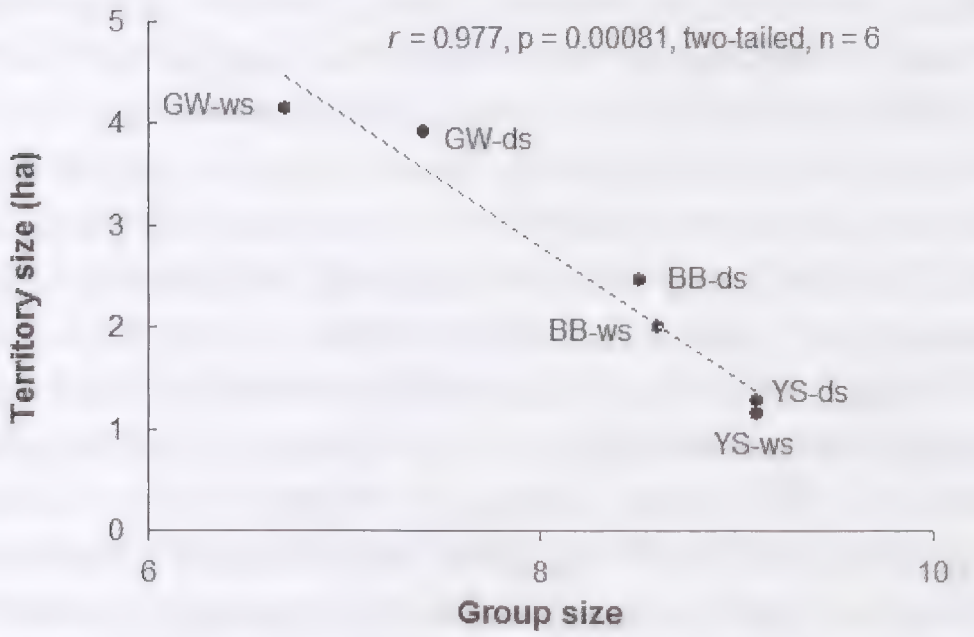

Figure 6. Correlation between mean territory size and mean group size for Yellow-billed Shrike (YS), Green wood-hoopoe (GW) and Brown babbler (BB) in the wet (ws) and dry (ds) seasons, at the Legon Campus, 2012–13.

Food provisioning rate and group size

Although food provisioning rate (F) across both seasons showed a positive correlation with group size for all three species, the relationship was only significant for the YS ($r = 0.897$, $P = 0.00253$, two-tailed, n = 7). However, when plotting group size against per capita food provisioning rates (F/G_B) all three species showed highly significant negative correlations between these two variables (Fig. 7), *i.e.* as group size increase, each individual on average supplies less food.

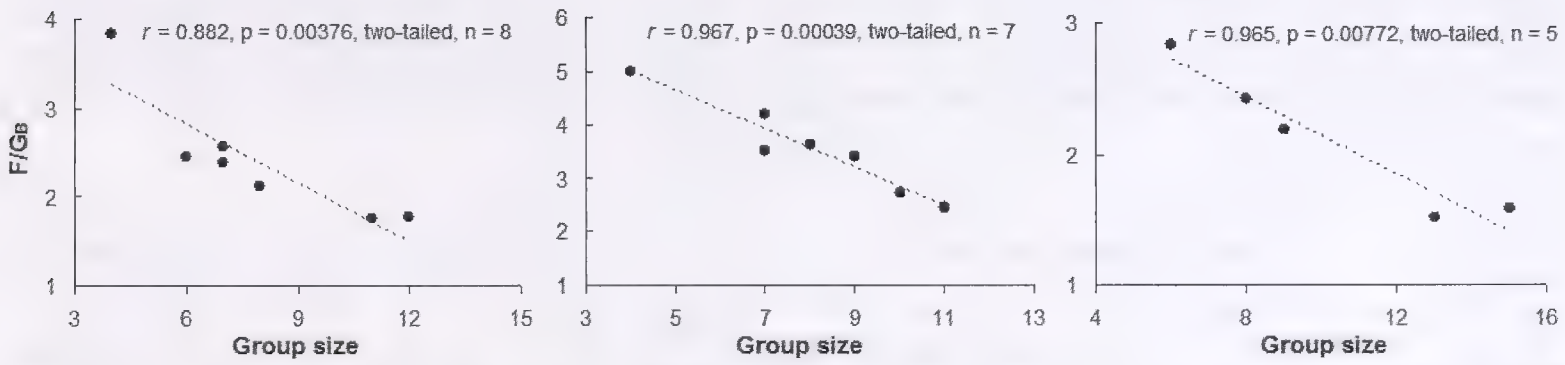

Figure 7. Correlation between per capita food provisioning rates (F/G_B) and group size (G_B) for Yellow-billed Shrike (left), Green Wood-hoopoe (centre), and Brown Babbler (right) at the Legon Campus, 2012–13.

Discussion

The abundance and density of cooperative breeders at Legon

Our population estimates for the YS are very similar to those recorded 40 and 10 years ago by Grimes (1980, 2006a) (Table 3). However, Grimes' (1980) estimate of YS territory size (mean 16.6 ha, range 10.6–27.1) was ten times larger than our estimates (mean 1.2 ha, range 0.4–3.0). Grimes (1980) estimated territorial boundaries by manually plotting the locations where disputes between groups were observed, on a 1:2500 scale map of the campus. We used a similar approach but calculated MCP areas based on distant occurrences of group members from the nest. As we did not colour ring any birds (which Grimes did), we may have overlooked some individuals during long-distance movements away from the nest, and our territory sizes represented absolute minima, as discussed above (Methods). Grimes (1980) reported that territorial disputes could be heard or seen up to 200 m from the nest. A 200 m radius around the nest encloses *c.* 12.6 ha, which is close to his estimated mean territory size (16.6 ha). However, we believe that his large territory size estimates could reflect occasional movements beyond the defended territory (*i.e.* more equivalent to the home range of groups), while our estimates were probably under-estimates of the actual defended territory. Home ranges may overlap greatly, whereas territories show minimal or no overlap (Monadjem *et al.* 1995). Given the high density of YS territories on the campus, territories larger than 5–10 ha would result in many greatly overlapping territories, which is contrary to the usual definition of territory. However,

even though the methods of territory size estimation were different, our consistently lower territory sizes suggest a genuine decrease in territory size of this species, although certainly not so great as our contrasting figures might indicate. The lower territory size could result from reduction in available and suitable habitat owing to more pavements, roads, parking spaces and buildings, largely void of vegetation, and consequently avoided by shrikes, as well as more territory boundaries defined by large buildings. Lack of suitable habitat may result in greater competition among groups, which therefore defend smaller areas, while large buildings may reduce the need for defence on some sides of the territory, and increased food availability in the form of scraps left by humans, which shrikes often ate (pers. obs.), might reduce the feeding area required per group. Whereas shrikes often foraged in busy areas among people, disturbance by humans may reduce the availability of suitable nesting sites, which were all in relatively quiet areas, so that remaining nesting sites are both fewer in number and more clumped in distribution. Thus, although suitable green areas are reducing, shrike numbers are not, perhaps because they can survive in smaller productive areas with limited breeding sites rather than expanding territory size, particularly where foraging and movement are constrained by large buildings.

Our estimate of average GW territory size (*c.* 4 ha) was much smaller than that recorded in the Eastern Cape Province of South Africa (23.5 ± 1.7 ha), whereas our average group size (*c.* 7) was over twice as large as recorded (mean *c.* 3, range 2–9) in that study (Radford & Du Plessis 2004). Similarly, elsewhere in South Africa, and in Kenya, field data indicate much lower GW population densities compared with ours: group and territory sizes were 3.0–4.9 birds and 35.1–51.0 ha respectively, with home ranges as large as 60–150 ha (Du Plessis *et al.* 2007). For the closely related Violet Wood-hoopoe *Phoeniculus damarensis* in Namibia, group and territory sizes also indicate lower densities, with respectively 4.3 ± 1.6 birds and 12.3 ± 3.0 ha (Du Plessis *et al.* 2007). Hence, it appears that at Legon, the density of GW is far higher than those of the two *Phoeniculus* species in more arid areas of southern Africa and Kenya, which could be attributed to differences in abundances of food or nesting sites, and indicates that, despite increasing degradation and conversion, the environment is still favourable for this species at Legon. As an obligate cavity-nester and rooster unable to excavate its own cavities, GW densities have been found to be limited by the availability of such cavities (Du Plessis 1992, Du Plessis & Williams 1994). Whereas fuelwood exploitation significantly reduces GW abundance (Du Plessis 1995), provision of artificial nest boxes may increase it (Du Plessis 1992). Therefore, even though many tree cavities have been lost to building and to indiscriminate tree felling and pruning by management at Legon, some GW have found substitute cavities under roofs, and its population seems viable although it may be subject to high intra- and interspecific competition for cavities (see below).

We found no published data on BB territory size or density, but our estimates of respectively 2–2.5 ha and 0.35 birds/ha are much smaller and more dense than those recorded for the related Arrow-marked Babbler *Turdoides jardineii* in arid areas

(450–750 mm annual rainfall) in the Transvaal of South Africa, which had respectively 37.5 ± 16.5 ha (range 10.5–63.5 ha) and 0.13–0.15 birds/ha, in an area regarded as saturated with territories (Monadjem *et al.* 1995). Moreover, average group size of BB in our study (*c.* 8.5) was also 60% higher than for Arrowmarked Babbler. These data suggest that Legon can support more babblers compared to more arid areas in South Africa.

The relationship between group and territory size

We found a positive correlation between group and territory size for the YS across the two seasonal data collection periods (Fig. 5), as has been observed in some other cooperatively breeding birds in Africa (Monadjem *et al.* 1995), although not in all (*e.g.* Thiele *et al.* 2008). Grimes (1980) did not find such a relationship in the YS, noting that the "densities" of larger groups (*i.e.* birds per ha) were generally two or three times those of smaller groups. Territories are on average smaller now than 10–40 years ago (Grimes 1980, 2006a), and our data suggest that larger territories can either sustain more birds, or require more group members to establish and maintain, or both (*cf.* Monadjem *et al.* 1995). Grimes (1980, 2006a) reported an average group size of 12 in the 1970s, reduced to *c.* 9 in 2004, similar to our 2012–13 estimates. These data suggest that group size has decreased with the reduction in territory size. Although the population size of this species on the campus has changed little, our data indicate that the limited availability of nesting sites may have resulted in smaller shrike territories, which are not able to support large groups, accounting for the reduction in group size since the 1970s.

We identified a negative relationship between group and territory size among the three species, contrasting with the positive intraspecific relationship between these variables for the YS. In other words, some species of cooperative breeders have larger territories which can be maintained by relatively smaller groups, as in the case of the GW. The GW is a relatively large, bark-gleaning insectivore that depends on tree cavities for nesting and roosting (Du Plessis 1992) and tree crevices for foraging, unlike the two other species which are smaller, mainly terrestrial gleaning and sallying insectivores; as such, GW may require larger territories than the other two species. GW had smaller groups, fewer but larger territories, and in effect lower population size and density, compared to YS and BB (Table 3). We had the general impression that GW was more mobile and active throughout the day than YS and BB, and food availability may contribute to its lower group size and territory density (Radford & Du Plessis 2004). Radford & Du Plessis (2004) also found no correlation between GW territory size and group size in South Africa, where territory size remained constant across the seasons. However, they also observed that during the breeding season, birds intensified foraging closer to the nest, and concluded that food was adequate within the territory, such that when group size increased, a higher proportion of the available area was being utilised rather than requiring increased territory size. Our findings from GW at Legon concur with this, suggesting that food

resources are sufficient and that the limiting factor for group expansion and possibly population size is rather lack of tree cavity nesting sites, a hypothesis supported by the fact that GWs were observed nesting in buildings.

The relationship between group size, clutch size and food provisioning rates

We did not establish any significant relationship between group size and clutch size or food provisioning rates for any of the three species, indicating that an increase in number of helpers did not result in increased food provisioning rates or reproductive output. Similar findings have been obtained from long-term studies of other Afrotropical cooperative breeders, *e.g.* Arrowmarked Babbler (Monadjem *et al.* 1995), Bare-cheeked Babbler *Turdoides gymnogenus* (Shaw & Shewry 2000) and GW (Du Plessis 1991). Monadjem *et al.* (1995) indicated that although extra adults in a group may not have enhanced the reproductive output of the breeding pair, they helped in the defence and enlargement of a territory in saturated habitat. In the Arabian Babbler *Turdoides squamiceps* in Israel, group size was sometimes found to be positively correlated with clutch size and food provisioning rate (Wright 1998, Anava *et al.* 2001) but sometimes not (Zahavi 1974), perhaps indicating local adaptation of breeding systems within cooperative birds. Similarly to the Arabian Babbler, in the Hinde's Babbler *Turdoides hindei* of Kenya (Shaw & Musina 2003) and the Southern Pied Babbler *Turdoides bicolor* of the Kalahari (Thiele *et al.* 2008), breeding outcome was positively correlated with adult group size. Du Plessis (1991) concluded that for GW in South Africa there was no evidence that helpers' feeding of young influenced their own indirect fitness. He noted that although non-breeders did not increase the net rate of food provisioning to chicks, they reduced parental input in chick rearing, and hence energy expenditure by the breeding pair.

All three species showed a negative relationship between group size and per capita food provisioning rate, which indicate that as group size increase, the average work load per helper is reduced. This was also found for GW by Du Plessis (1991) and in Arabian Babbler, where load for all helpers was reduced, as each group member delivered food at similar rates (Wright 1997, 1998, Anava *et al.* 2001). Contrary to our expectations and the findings of Wright (1998), but similar to Zahavi (1974), we did not establish any clear relationship between the "clutch" size (variable C) and food provisioning rates for any of the three species.

Infrastructural development and conservation of cooperative breeders at Legon

Although the Legon Campus has undergone tremendous infrastructural developments since Grimes (1980) conducted his first study on the breeding ecology of the YS in the 1970s, our data and those of Grimes (1980, 2006a) on this species indicate a high resilience towards these disturbances. Whereas nests of YS were primarily found in the central portions of the campus, the two other species were more widely spread with no particular concentration in central or outlying portions. The obligate cavity-nesting GW was mainly associated with areas containing many old, large trees, and its

larger territories and higher mobility may be explained by the increasing rarity of old trees with cavities and creviced bark on the campus. The pace at which building is taking place at Legon inevitably reduces nesting opportunities as trees are removed, and in recent years many old or dead trees (*e.g.* large avenue African Mahoganies *Khaya senegalensis*) have been cut or trimmed indiscriminately by grounds and gardens management, further reducing the density of nesting cavities.

Once breeding began, GW groups often reacted aggressively towards all non-group members as well as other species, but when breeding was over only conspecifics were repelled. This, together with the fact that some of the groups nested under roofs, also suggests that nest sites might be a limiting factor for GW, although perhaps not for the other two species, which are cup nesters. As nesting trees disappear, the many other hole-nesters on the campus (*e.g.* parrots, starlings, barbets, woodpeckers and hornbills) will intensify the competition for nesting sites among the GW. It is currently unknown to what extent other hole-nesters at Legon influence territory size of GW. Studies of interspecific competition among hole-nesters are required to understand fully the dynamics of territory and group size of the GW at Legon.

There were only small seasonal changes in the location and sizes of the territories occupied by the three species. Similarly low circannual variation in territory dynamics were reported for the YS by Grimes (1980), as well as for the GW (Radford & Du Plessis 2004). Seasonal changes in climatic conditions may influence arthropod availability which could affect food provisioning rates and hence clutch size, but the lack of any significant relationship between the clutch sizes and food provisioning rates suggests that seasonal environmental changes have little effect on the breeding of any of the three species. On the other hand, we observed somewhat higher breeding activity in all three species during the dry season which was contrary to our expectations, as higher rainfall is normally correlated with higher insect abundance. However, although we compared two distant seasonal periods, these did not cover the full extent of the seasons at Legon, so our conclusions on circannual variation are made with caution. Apart from food abundance, other factors may affect breeding success such as weather conditions and invertebrate parasites, and we cannot rule out that such factors act more negatively during wet periods. In this context, some rainforest birds in areas of particularly high rainfall avoid breeding during the rainy season, where the high frequency and intensity of rainfall may restrict foraging time, foraging efficiency, food provisioning rates and reproductive output (Serle 1981, Tye 1992, Boyle *et al.* 2010, Jahn *et al.* 2010). Another potential factor affecting breeding timing and success is that the student vacation falls within January–February, which means that disturbance levels then are much lower compared to September–October when student numbers peak. Therefore, disturbance at the nest may also affect breeding success at Legon, as may construction work, but we did not monitor such activities during the two study periods. Future studies should therefore monitor habitat changes and other effects of construction work on cooperatively breeding birds at Legon.

Acknowledgments

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Short Notes — Notes Courtes

First and second records of African Pygmy Goose *Nettapus auritus* on São Tomé

Hansson & Thomasson (2014) published a record, with photographic evidence, of an African Pygmy Goose *Nettapus auritus* in the southeast of São Tomé Island in the Gulf of Guinea. This was correctly reported as the first fully documented record of the species on São Tomé, although Hansson & Thomasson (2014) noted that it was referenced on the IUCN Red List (http://www.iucnredlist.org/) as a vagrant to the country (São Tomé e Príncipe). However, the source of this reference could not at the time be traced.

The reference was in fact based on PR's observation of one bird, seen very well for an extended period at Micoló on the northeast coast of São Tomé, on 15 July 1999. The observer was familiar with the species although a description was not published when the record was briefly noted by Demey (2000), and cannot now be found. However, African Pygmy Goose would be difficult to confuse with anything else on the islands, and PR was aware at the time that this would be a first record for São Tomé, so looked carefully.

The 1999 record was also the basis for Borrow & Demey's (2001) listing of the species as vagrant to São Tomé, and indeed the 2011 record confirms that it is an occasional vagrant to the island.

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News & Comment — Nouvelles & Commentaires

African vultures declining at a critical rate

A recent study suggests that African vultures are heading towards extinction. An international team of researchers says African vultures likely qualify as Critically Endangered under the International Union for Conservation of Nature's threat criteria. Their report, released in May (Ogada, D. *et al*. 2015. Another continental vulture crisis: Africa's vultures collapsing toward extinction. *Conserv. Lett.* DOI: 10.1111/conl.12182), includes the first continent-wide estimates of decline rates in African vultures, and suggests that many national parks and game reserves appear not to offer vultures effective protection.

Vultures take several years to reach maturity, and typically fledge only a single offspring every 1–2 years. Since six of the eight species are largely or wholly confined to Africa, and are projected to decline by at least 80 % over three generations, they are likely to qualify as Critically Endangered. Because vultures are so mobile and can easily travel hundreds or thousands of kilometres, decline rates were worryingly high even within protected areas.

Continent-wide declines have already been reported in four Asian vulture species. However the study's authors highlight two important distinctions between the Asian vulture crisis and that in Africa. First, to date, the rates of decline in Africa have been substantially lower than in Asia, affording African governments an opportunity to head off the collapse in this functionally important group. Second, while Asian vultures declined largely as a result of a single factor (ingestion of the anti-inflammatory drug Diclofenac), African vultures face multiple threats, including incidental and deliberate poisoning, the illegal trade in body parts for traditional medicine, killing for bushmeat, mortality caused by power lines and wind turbines, and a reduction in habitat and the availability of food from wild animal populations.

The study suggests that the greatest quantifiable threat to Africa's vultures is poisoning, which accounted for 61% of all reported deaths. African vultures are often the unintended victims of poisoning, as carcasses are baited with highly toxic agricultural pesticides to kill livestock predators. However the study also shows that the recent increase in elephant and rhino poaching throughout Africa has led to a surge in the number of vulture deaths recorded, as carcasses have been poisoned specifically to eliminate vultures, whose overhead circling might otherwise reveal the poachers' activities. The authors propose a range of measures to address these threats, including more effective regulation of agricultural and other chemicals commonly used as poisons. This would benefit not just vultures, but all species targeted by pastoralists and poachers in Africa. The catastrophic collapse of South Asia's vultures over a decade ago unified governments there to ban the use of veterinary diclofenac. Saving Africa's vultures will require support from African Governments, and outreach

programmes geared toward pastoral communities, to ensure that they perceive vultures as a vital and integral component of ecosystems and economies.

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West African Bird DataBase (WABDaB) new countries and new logo; and new records wanted

WABDaB has a new logo, as shown here. We happily acknowledge Nik Borrow's contribution of the Abyssinian Ground Hornbill *Bucorvus abyssinicus* image for this.

For those who didn't know yet: the Niger Bird DataBase is now the West African Bird DataBase (<www.wabdab.org>, although the old <www.nibdab.org> will also work for a little longer). WABDAB is an on-line, bilingual (English and French), open access database for bird records, images and distribution maps from, at present, Niger, Chad and (just starting) Burkina Faso. Thanks especially to Tim Wacher of the Zoological Society London and the Sahara Conservation Fund, WABDaB already contains 7410 records of 340 species from Chad, as well as 414 photos of 187 species. Tim is also one of the WABDaB country administrators for Chad. Over the past six months four new species for Chad have been documented, with two others awaiting details.

Please submit to the WABDaB any bird records you have from Niger, Chad or Burkina Faso. You can enter them on-line on the website after a simple registration procedure that allows us to check back with you on any unusual sightings. You may also send your records to Joost Brouwer in an Excel file, for which Joost can send you an example file and brief instructions. Details on unusual sightings, including descriptions, can be added in the Remarks field. We are always willing to help with uploading and identification problems. It is your records that make the WADaB a living conservation and research tool.

After a record has been included, any associated images can be uploaded as well. The photographers retain the copyright to any image uploaded. The WABDaB is programmed to reduce image files to 800 pixels along the longest side, which makes the images easier to look at with a slow internet connection and also discourages unauthorised use. Anyone interested in an image in the WABDaB can contact the copyright holder via the WABDaB administrators.

Joost Brouwer (Content Manager) and Ulf Liedén (Webmaster/Programmer)
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Society Notices — Informations de la Société

The webmaster would like to retire!

This is an appeal from the W.A.O.S. webmaster. I have worked on the W.A.O.S. website (http://malimbus.free.fr/) since 2003 but now think it prudent that someone else take over. My age is 88 and I am still able to brief my successor, but this situation may not last long.

The most essential task is to update the website twice a year with the Table of Contents of each issue of *Malimbus* and summaries of papers. Then, each year, the full texts of the issues published five years previously need to be added. If time is available, there are other jobs such as updating country pages and posting news items about the Society. The website is bilingual English/French in the same manner as *Malimbus*.

If you are interested in learning more about this position or taking over this work, please contact me.

Peter Browne
<pbrowne@primus.ca>

Le webmestre souhaiterait être remplacé!

Ceci est un appel du webmestre de la Société Ornithologique de l'Ouest Africain: j'ai assuré le fonctionnement du site internet de la S.O.O.A. (http://malimbus.free.fr) depuis 2003 et je pense qu'il est maintenant prudent que quelqu'un d'autre reprenne cette fonction. J'ai 88 ans et pense être encore capable de mettre au courant mon successeur, mais ne pourrais peut-être le faire encore longtemps.

La tâche la plus essentielle est d'actualiser le site internet deux fois par an avec le sommaire de chaque numéro de *Malimbus* et les résumés des articles. Puis, chaque année, les textes intégraux des numéros publiés cinq ans auparavant doivent être ajoutés. Si l'on est disponible, il faut aussi réaliser d'autres travaux tels que mettre à jour les pages par pays et publier les informations relatives à la Société. Le site internet est bilingue Anglais/Français, comme *Malimbus*.

Si vous souhaitez plus d'informations sur ce poste ou êtes prêt à reprendre cette fonction, merci de prendre contact avec moi.

Peter Browne
<pbrowne@primus.ca>

Instructions aux Auteurs

Malimbus publie des articles de recherche, des revues de publications et des nouvelles traitant de l'ornithologie ouest-africaine.

Les **Articles** et les **Notes Courtes** doivent être des apports originaux; ceux déjà publiés ailleurs, en partie ou en totalité, seront normalement refusés. Les Notes Courtes sont des articles de moins de 1500 mots (références comprises) ou de quatre pages imprimées. Autant que possible, les manuscrits auront été au préalable soumis à au moins un ornithologue ou biologiste pour un examen minutieux. Les manuscrits seront envoyés pour critique à au moins un lecteur spécialiste.

Les textes des **Nouvelles & Commentaires** ne devraient pas dépasser 1000 mots.

Les **textes** sont acceptés en anglais et en français; la Rédaction pourra aider les auteurs dont la langue maternelle n'est pas l'une de celles-ci. Nous préférons les envois de manuscrits par email (en pièce jointe). Consultez le Rédacteur pour plus de détails, par ex. les logiciels compatibles.

Tous les Articles (mais non les Notes Courtes) comporteront un **Résumé**, n'excédant pas 5 % de la longueur totale. Le Résumé mentionnera brièvement les principaux résultats et conclusions de l'Article et ne sera pas un simple compte rendu de ce qui a été fait. Les résumés seront publiés à la fois en anglais et en français (ou dans la langue officielle du pays dans lequel le travail a été réalisé) et seront traduits au mieux par la Rédaction.

La **présentation** des tableaux, chiffres, unités métriques, références, *etc*. doit correspondre à celles des numéros récents. A notez, en particulier: Les noms des auteurs doivent être listés en faisant précéder le nom de famille par le prénom ou des initiales (ex. John A. Smith); les dates seront écrites "2 fév 1990" mais les mois seuls pourront être écrits en entier; les heures seront écrites "6h45", "17h00"; les coordonnées "7°46′13″N" (pas de zéros en tête) ou en degrés décimaux jusqu'à cinq décimales (ex. 1.23456°N), mais non en minutes décimales; les nombres jusqu'à dix seront écrits en toutes lettres, excepté devant une unité de mesure (ex. 6 m); les nombres à partir de 11 seront écrits en chiffres sauf au début d'une phrase. Toutes les références citées dans l'article, et aucune autre, doivent figurer dans la bibliographie.

La **séquence taxonomique** et les **noms scientifiques** (et de préférence les **noms vernaculaires**) doivent suivre Borrow & Demey (2001, *Birds of Western Africa*, Christopher Helm, London) avec des noms (main ne pas la séquence) rectifiés de Borrow & Demey (2014, *Birds of Western Africa*, Bloomsbury, London), ou *The Birds of Africa* (Brown *et al*. 1982, Urban *et al*. 1986, 1997, Fry *et al*. 1988, Keith *et al*. 1992, Fry & Keith 2000, 2004, Academic Press, London), à moins de donner les raisons de s'écarter de ces auteurs. Cependant, les termes "Commun" et "Africain" ne doivent être utilisés que s'ils font partie d'un nom commun employé de longue date.

Les **articles sur l'avifaune** doivent comprendre une carte ou un index géographique, incluant tous les endroits cités. Ils doivent comporter quelques brèves indications sur le climat, la topographie, la végétation et les circonstances ou événements inhabituels avant ou pendant l'étude (ex. pluies tardives, *etc*.). Les **listes d'espèces** ne doivent contenir que des enregistrements importants: les listes complètes ne sont justifiées que pour les régions encore non étudiées ou délaissées pendant long-temps. Autrement, ne citer que les espèces sur lesquelles l'étude fournit une information nouvelle sur la répartition, la période de séjour, la reproduction, *etc*. Pour chaque espèce, indiquer l'extension de l'aire de répartition, une estimation d'abondance (*Malimbus* 17: 38) et les données datées sur la reproduction; indiquer le statut migratoire et la période de séjour seulement tels qu'ils ressortent de l'étude. Eventuellement, replacer les données dans le contexte en les comparant brièvement avec une liste régionale de référence. Les longues listes d'espèces peuvent être présentées sous la forme de tableaux (ex. *Malimbus* 25: 4–30, 24: 15–22, 23: 1–22, 1: 22–28, or 1: 49–54) ou sous la forme rédigée des numéros récents. Un **guide plus complet à l'intention aux auteurs** d'articles sur l'avifaune, comprenant l'échelle d'abondance des espèces conseillée, a été publié dans *Malimbus* 17: 35–39 et une version augmentée de celle-ci mise sur le site internet (http://malimbus.free.fr/instmale.htm). La Rédaction se fera un plaisir de donner des conseils pour les études spécifiques.

Pour le dessin des **Figures**, et en particulier la taille des caractères, tenir compte des dimensions de la page de *Malimbus*. On préfère les figures préparées sur logiciel graphique et sauvegardées en haute définition. Les fichiers de basse résolution et les impressions de mauvaise qualité seront refusés. Les auteurs sont encouragés à soumettre des **photographies** qui illustrent des points importants de leur article. Les photographies doivent être en couleurs et de haute définition. Les figures et les photographies doivent être envoyées comme fichiers de logiciel graphique (par ex. jpg ou tif), et non pas être incluses dans un fichier de Word. Consulter le Rédacteur pour tout renseignement.

Un fichier pdf des Articles et des Notes Courtes, et une copie du numéro de publication seront envoyés gratis à l'auteur ou à l'auteur principal.

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